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# **SUBSTITUTE SPECIFICATION**

**DEVICE FOR THERMALLY SHRINKING TOOLS**

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**Device for thermally shrinking tools**

The invention relates to a device for thermally shrinking and expanding tools and other machine parts in a holder.

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It is known in the metalworking and woodworking industry thermally to shrink tools in a holder. This is done by heating the holder and then inserting the tool shank. On cooling, the holder closes around the shank to create a firm, high-precision tool-holding device.

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To enable the shank to be removed (tool expansion), the holder must be made of a material which has a larger thermal expansion than the shank. For a shank made of hard metal with a coefficient of thermal expansion of  $6 \cdot 10^{-6}$ , an example of a suitable holder is one made of steel, which has twice the thermal expansion. A steel shank would in turn require a holder made of an aluminium alloy with a coefficient of thermal expansion twice that of steel.

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If the holder and the shank to be shrunk are made of materials with the same or approximately the same thermal expansion, it is still possible to shrink the shank because only the holder is heated in the shrinking process, the shank being cold. Tool expansion is normally no longer possible because, when the holder is heated, the good thermal conductivity of metals is such that the shrunk shank heats up and expands together with said holder.

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Even for shrinking, the shank has to be introduced quickly because the heat transfers very rapidly from the holder to the shank due to the good thermal conductance of metals.

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The smaller the bore of the holder, the smaller is the thermal expansion on heating and the more exacting are the work tolerances. For example, if the thermal expansion is 0.048 mm for a bore diameter of 20 mm, then for the same material it is only 0.0072 mm for a bore diameter of 3 mm.

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DE-19638808-A1 discloses a tool holder in which the tool shank is shrunk not in the clamping chuck but in a collet chuck. The latter is conventionally inserted in the conical housing of the clamping chuck by means of tensioning nuts. This device suffers from the same problems between collet chuck and tool shank as do  
5 the conventional shrink chucks in which a tool shank is shrunk directly.

The object of the invention is to avoid these disadvantages associated with thermal shrinking.

10 This is achieved according to the invention by means of a sleeve inserted in the bore of the holder, said sleeve preferably being made of a material with a low thermal conductivity.

A preferred embodiment of the invention will be described below with the aid of  
15 the attached drawing.

The drawing is a sectional diagram of a tool holder 1 with an inserted tool 2, which in this case is a twist drill. The width of the bore 3 of the holder is approximately twice the diameter of the drill shank. A sleeve 4 is located between the drill 2 and  
20 the holder. The sleeve is provided with slits cut in from one end, or alternately from both ends, to assure a degree of elasticity. However, the slits can also be omitted, depending on the material and the wall thickness.

As stated, the material of the sleeve 4 preferably has a low thermal conductivity so  
25 that the heat transfer from the heated holder to the tool is substantially delayed.

If the sleeve material does not have an especially low thermal conductivity, tool shrinking and expansion are facilitated by the greater thermal expansion due to the larger diameter of the holder, the only condition being that heating takes place  
30 rapidly, as in the case of inductive heating.

Apart from a low thermal conductivity, however, the material must also have a sufficiently high strength, toughness and hardness to cope with the stresses applied. Certain ceramic materials, e.g. zirconium oxide ceramic, offer this combination of properties.

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The sleeve can be inserted in the tool holder in a variety of ways. It can either be inserted in the holder as an interchangeable reducing sleeve or fixed firmly to the holder, e.g. by press-fitting, adhesion, screwing, etc.

- 10 The advantages of interchangeable sleeves are as follows: With a holder of specific bore diameter, the insertion of interchangeable reducing sleeves makes it possible to clamp tools with different shank diameters.

- 15 When the holder is heated, the greater thermal expansion of the bore of the holder is transferred linearly through the reducing sleeve to its smaller bore. In this way, tool shanks made of a material with the same coefficient of thermal expansion as the holder can be shrunk and also expanded again.

- 20 Another advantage is that the small bore diameters of the reducing sleeve do not have to be manufactured with such extremely small work tolerances.

If overstressing causes the tool shank to rotate in the housing, at worst the reducing sleeve, and not the holder, will be damaged.